

REMARKS

Claims 1 and 3-19 are pending. Claim 2 is cancelled. Claim 1 is amended to incorporate claim 2. Similarly, claim 4 is amended to incorporate claim 5. No new matter is presented.

Claims 1, 7, 9, 11, 13, 15, 17, and 19 stand rejected under 35 USC 103(a) as unpatentable over Hirukawa, U.S. Patent Application Publication No. 2003/0048825 A1, in view of any of the following: Matsubara, Japanese Patent No. 03-064980 (called "HAPA-1" by the Examiner); Tatsumi, Japanese Laid-open Patent Application No. 11-274644 (called "AAPA-1" by the Examiner); and Matsumoto, Japanese Laid-open Patent Application No. 11-112087. This rejection is respectfully traversed.

This rejection of the claims is rendered moot by the inclusion of the limitations of allowable claim 2 in claim 1. Therefore, amended claim 1 is allowable.

Claims 7, 9, 11, 13, 15, 17, and 19 are at least allowable due to their respective dependencies from claim 1.

Claims 4, 8, 10, 12, 14, 16, and 18 stand rejected under 35 USC 103(a) as unpatentable over Hirukawa as variously modified in view of secondary references.

Hirukawa fails to disclose all of the elements of the invention as claimed. None of the other references alone, or in combination with Hirukawa, discloses the elements of claim 4.

The Examiner characterizes Hirukawa as disclosing several elements of claim 4, including a "p-side barrier layer [that] is present on a side of the lower guide layer" and that the "n-side barrier has a thickness of 70 Å or more." The Examiner asserts that the thicknesses of the p- and n-side layers are insignificant. In minimizing those differences, however, the Examiner overlooks an element of the invention as claimed (see Applicants' Specification, page 16, lines 20-25 through page 17, lines 1-3). The Examiner also disregards how Hirukawa works. In particular, Hirukawa discloses p- and n-side barriers of equal thicknesses (100 Å) (see Hirukawa, paragraph [0057]). Hirukawa also discloses trapping emitted light using the refractive index of the air. "In the semiconductor laser device having the aforementioned hollow portion

130, use of InGaAsP based material for the quantum well active layer 105 decreases difference in refractive index between the hollow portion 130 and the quantum well active layer 105 compared to the conventional case, thereby providing an acceptable difference of refractive index sufficient for stabilizing a single transverse mode oscillation.” (see Hirukawa, paragraph [0062]) Everything has a refractive index – from substances composed of hard metals to those made of the softest plastics. Of course, air has a refractive index.

The refractive index of a medium is simply defined as a measure for how much the speed of light is reduced inside a particular medium. In other words, the index is the ratio of the speed of light in a vacuum to the speed of light in a given medium. In Hirukawa, this refractive index becomes an issue because the speed of light is reduced when light particles emitted from the light-emitting component are disrupted in the semiconductor’s hollow portions (see Hirukawa, paragraph [0062]). Inside these empty portions filled by plain air, the physical phenomenon representing air’s refractive index affects the way the light is guided (see Hirukawa, paragraph [0062]). The air causes light to be trapped, thereby increasing the efficiency of the semiconductor device.

Claim 4, in contrast, recites an n-side barrier in which electrons of light pass from the lower guide through the n-side barrier and finally into the claimed quantum well active layer. Once in the active layer, the electrons bounce off the p-side barrier. They stop traveling forward and are unable to travel back to the n-side barrier either. From the opposite side of the device, holes are injected. Holes occur when an electron in an excited state is pulled off of an atom. It is said that the absence of the electron leaves a hole in the outer valence layer of the atom. Like the electrons that are traveling from the opposite side of the semiconductor device as claimed, these holes pass through the upper guide layer of the claimed device, through the claimed p-side barrier, and finally into the claimed quantum well active layer. Once in this layer, they bounce off the claimed n-side barrier.

In a manner similar to the electrons, the holes become trapped in the claimed quantum well active layer. Since the holes and electrons are trapped in the quantum well, the device functions more efficiently because the device is using emitted light with greater efficiency. The claimed structure that facilitates the process described above has nothing to do with the Hirukawa's disclosure. Simply stated, the refractive index of air tells one of ordinary skill in the art nothing about trapping electrons and holes in a quantum well active layer. Moreover, the process of electrons and holes tunneling into the quantum well active layer of a semiconductor device is entirely different from light being slowed down by the air in hollow portions of a semiconductor. Accordingly, no person of ordinary skill in the art would have had reason to consider Hirukawa at the time the invention was made. In addition, Fukunaga, U.S. Patent No. 6,127,691, and Nishiguchi, U.S. Patent No. 6,154,476, fail to cure the deficiencies of Hirukawa.

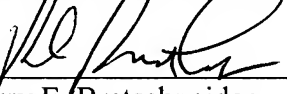
Therefore, claim 4 is allowable. Claims 8, 10, 12, 14, 16, and 18 are at least allowable due to their respective dependencies from claim 4. Accordingly, applicants respectfully request the rejection under 35 USC 103(b) be withdrawn.

In view of the above, each of the claims in this application is in condition for allowance. Accordingly, applicants solicit early action in the form of a Notice of Allowance.

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, applicants petition for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing Docket No. **204552032000**.

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